Final Report

IRAS Software Analysis Library[1]

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Executive Summary

The goal of this project was to collect "research software" written in IDL[1] to support analysis of IRAS data and make it available to the larger community. "Research software" describes software created by researchers and staff for a specific research goal, but lacks sufficient documentation, easy-to-use interfaces, and rigorous debugging. Additionally, most of the IDL/IRAS code available needed to be ported to a (largely) hardware independent new version of IDL. This report summarizes the activities and results of the one year grant. Due to the absence of Prof. Domik during the University year 1990/1991, the project received a no-cost extension of six months.

This report details:

- a list of IRAS/IDL functions that were created/modified under this grant;
- examples of these functions.

All software modules were incorporated into the IDL Astronomy Library by W. Landsman at GSFC.

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1. "Interactive Data Language" by Research Systems, Inc.

IRAS/IDL functions created/modified

Most of the software listed below was produced over the last five years by researchers, students, staff or visitors at CASA other than proposal investigator and research assistant. An exception is the software to preprocess IRAS images from skyflux data, which was developed by Gitta Domik. All other programs were modified, documented and tested by C. Scott Merkle.

All functions are now available through ASTRON.TLB, an astronomical IDL library, supported through a different NASA grant and supervised by Wayne Landsman at GSFC.

Programs	Description
IRAS_DISPLAY	Displays one selected band of IRAS skyflux plate. Several display options are available.

Procedures Used by IRAS_DISPLAY

COLORBAR	Displays color bar on the right edge of the display.
CONT_HARD	Creates file of contour plot of IRAS image that can be printed on a postscript printer.
CONT_OVER	Overlays a contour plot of an image on the image display.
CURS_BLOW	Zooms a section of an image.
DISPL_STRETCH	Converts a floating point image to a byte image giving the statistically best min/max range.
DWEK	Finds the Eli Dwek temperature from the ratio of two IRAS bands.
IRASAXIS	Draws the coordinate RA and DEC axes on the screen corresponding to the appropriate plate.

IRASBHR	Obtains plate header information from the binary .bhr file
IRASHDR	Obtains plate header information from the ASCII .hdr file.
IRAS_READ	Obtains a floating point array of an IRAS image from disk.
IRAS_RESET	Resets the graphics system variables.
IRASRAXY	Obtains the sample and line number for a given IRAS plate and specific RA and DEC.
IRASXYRA	Obtains the RA and DEC in both decimal and h,m,s for a given IRAS plate no. and line and sample number.
STRBLK	Removes all the blanks from a string.
STRNAM	Removes all the characters that cannot be used in a filename.

Supplementary Programs for IRAS processing

AP_MASK	Calculates the subarray used to determine the contribution of each pixel in a box array to a simulated circular aperture.(Used by IRAS_FLUX).
BANDS	Obtains floating point and calculates byte arrays of all the bands of one IRAS HCON image.
BB_FLUX	Gives the blackbody flux.
CONTAXIS	Labels RA and DEC axis on a contour plot drawn by CONT.
DECIMAL	Converts from degrees to decimal.

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GS_IMAGE	Scales an image according to a color table.
HCONS	Obtains floating point and calculates byte arrays of all IRAS HCONS of one wavelength(band).
IRASCENTER	Calculates the center RA and DEC for a given IRAS plate.
IRASLST	Assembles header file from FITS header information.
IRAS_STRETCH	Linear stretching/compressing of floating point values to byte values.
IRAS_CURSOR	Obtains the RA and DEC for a selected point on an IRAS plate.
IRAS_FIND	Obtains the plate and tape information given a specific RA and DEC.
IRAS_FLUX	Obtains RA, DEC, and flux value for a selected point on an IRAS plate.
IRAS_GS_QMS	Creates an image file to be printed on a QMS printer.
RA_BLOWUP	Gets a section of an image using RA and DEC input and zooms it.
STAR_PLOT	Marks the star type on a contour plot given the RA,DEC and Star Type.
STRDEC	Converts a string array, where each element has 3 components (hr,min,sec), to a floating point array.
TMPR	Calculates the color temperature of an IRAS image.
QMS_CT	Loads a color table that has the same scaling as IRAS_GS_QMS.

WINDOW_TO_PS   Reads a window from an X-window display saving it to an array and to a postscript formatted file for later printing.

Preprocessing tools for IRAS skyflux plates

IRAS_FLATTEN   Flatten the background of an IRAS image.

Procedures used by IRAS_Flatten

PLANE   Fits a plane through 4 points(least squares fits)

HP   Fits a hyperbolic paraboloid through 4 points.

IRAS_DESTRIPE   Removes periodic stripes from the IRAS image.

Procedures used by IRAS_Destripe

FRQ   Estimates the frequency of stripes in IRAS skyflux image.

CAL_SLOPE   Estimates the slope of stripes in IRAS skyflux images.

Merging and mosaicing routines

ADDPLATE_3   Adds or merges three hcons of an IRAS plate

ADDPLATE_2   Adds or merges two hcons of an IRAS plate

ADD_BANDS   Reads the floating point and byte arrays of all the bands of an addplate image.

PLATES   Combines two IRAS plates that are next to each
                        other and have the same declination or radial
                        ascension.

Procedures used by PLATES

HORZ   Combines two IRAS plates that are next to each
                        other and have the same declination.

IMGET   Reads the floating point array of an IRAS
                        image from a .dat file.

MINMAX2   Converts floating point image to byte non-
                        statistically.

VERT   Combines two IRAS plates that are next to each
                        other and have the same RA.

Examples

The next pages show samples of IDL/IRAS functions.

Publications describing efforts of this grant:

Domik, G., Brugel, E.W., Stencel, R.E., Vasudevan, S., Pang, J. 1990,
Workstation based Preprocessing of IRAS Skyflux Images, Publications of the
Astronomical Society of the Pacific, October 1990.

Domik, G., Brugel, E.W., Stencel, R.E., Vasudevan, S., Pang, J. 1990, *Applica-
tions of IRAS Preprocessing at the Workstation*, 176th meeting of the American
Astronomical Society, BAAS Vol. 22, No. 2, 1990

Acknowledgements

List of Figures
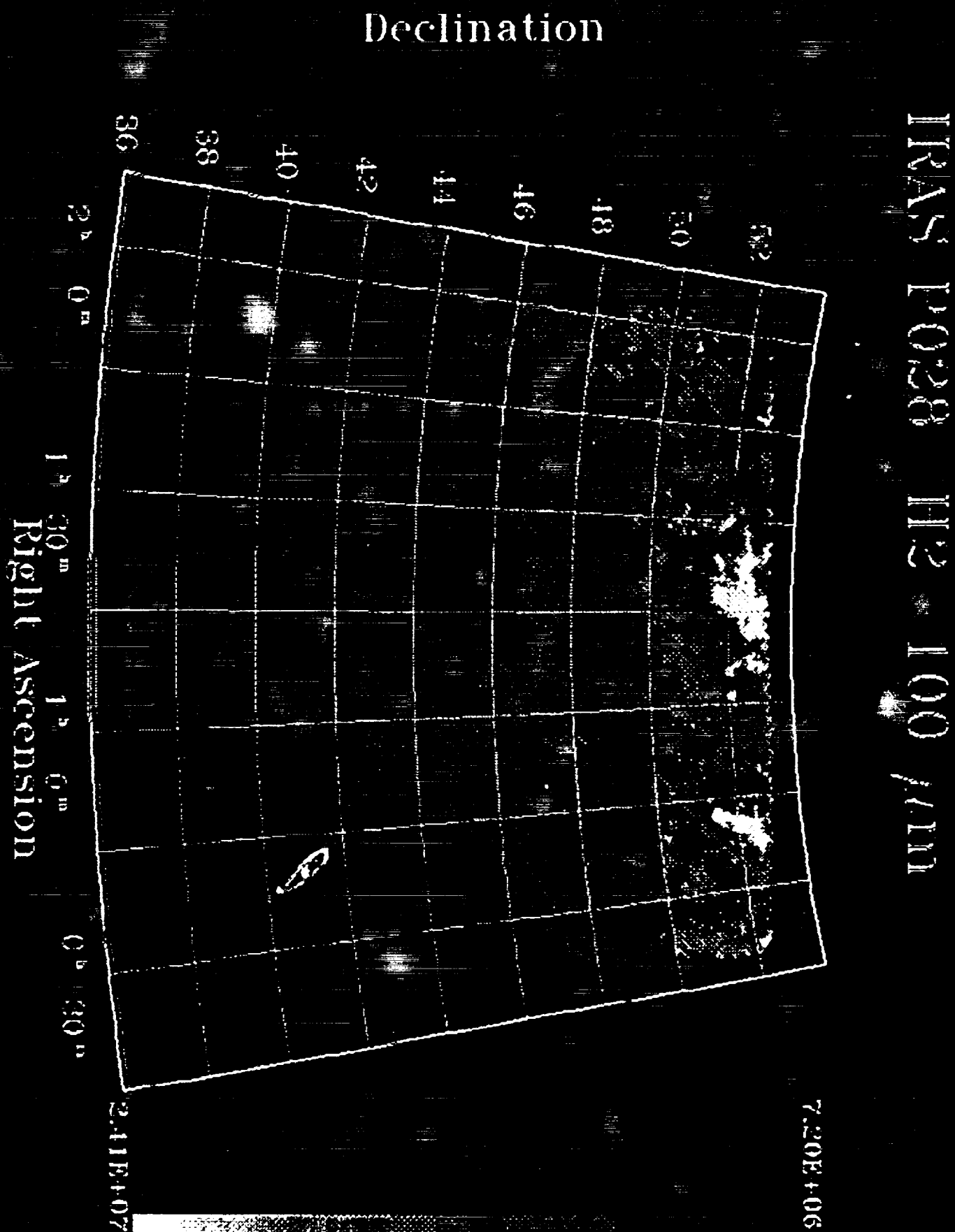
Figure 1: Use of IRAS_DISPLAY to display Skyflux Plate 28 with coordinate grid. Andromeda galaxy is to the lower right.

Figure 2: IRAS_DISPLAY offers optional annotations, such as contour lines.

Figure 3: Zooming up Andromeda galaxy.

Figure 4: Ratio images calculating the Eli Dwek temperature can be created through the program DWEK.

Figure 5 (a): The original Skyflux Plate 75 (band 3) shows sensor deficiencies in need of image restoration.

Figure 5 (b): Skyflux Plate 75, band 3, after flattening (IRAS_FLATTEN).

Figure 5 (c): Skyflux Plate 75, band 3, after flattening and destriping (IRAS_DESTRIPE).

Figure 6: Result of mosaicing several IRAS Skyflux Plates (PLATES):

77	76
101	100

In the center is Lambda Orionis. The color table from Figure 1 is used, after a 1σ statistical stretch on the original skyflux values.

Figure 7: To the left is HCON 3 (band 4) of plate 28. The missing scanlines visible in the Andromeda region are filled out by data from HCON 1-2 in the right image (ADDPLATE_3). The scale at the bottom relates the pseudo color of the image to low data values (blue) up to high data values (yellow).
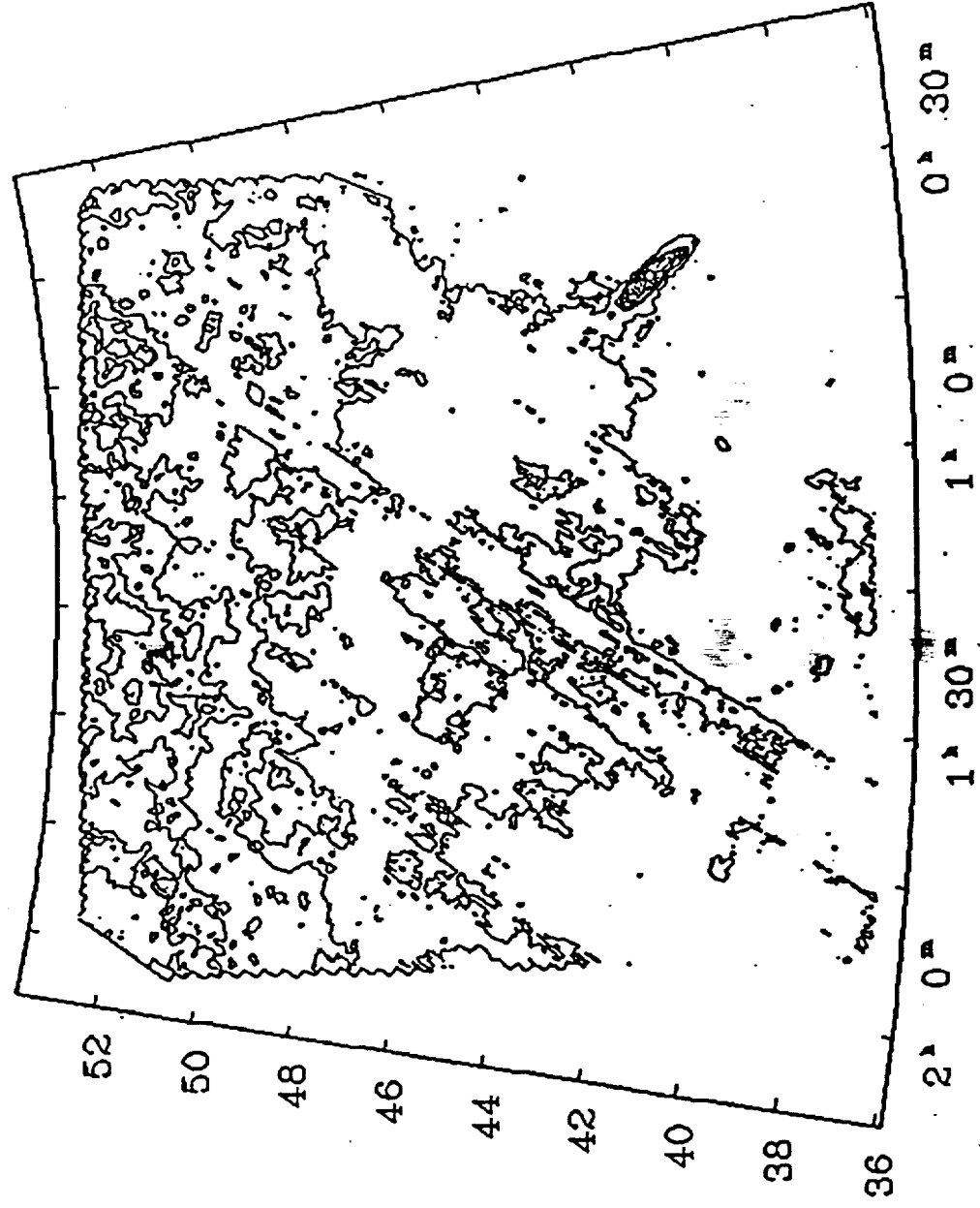
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IRAS P028 H2 100 μm

Right Ascension

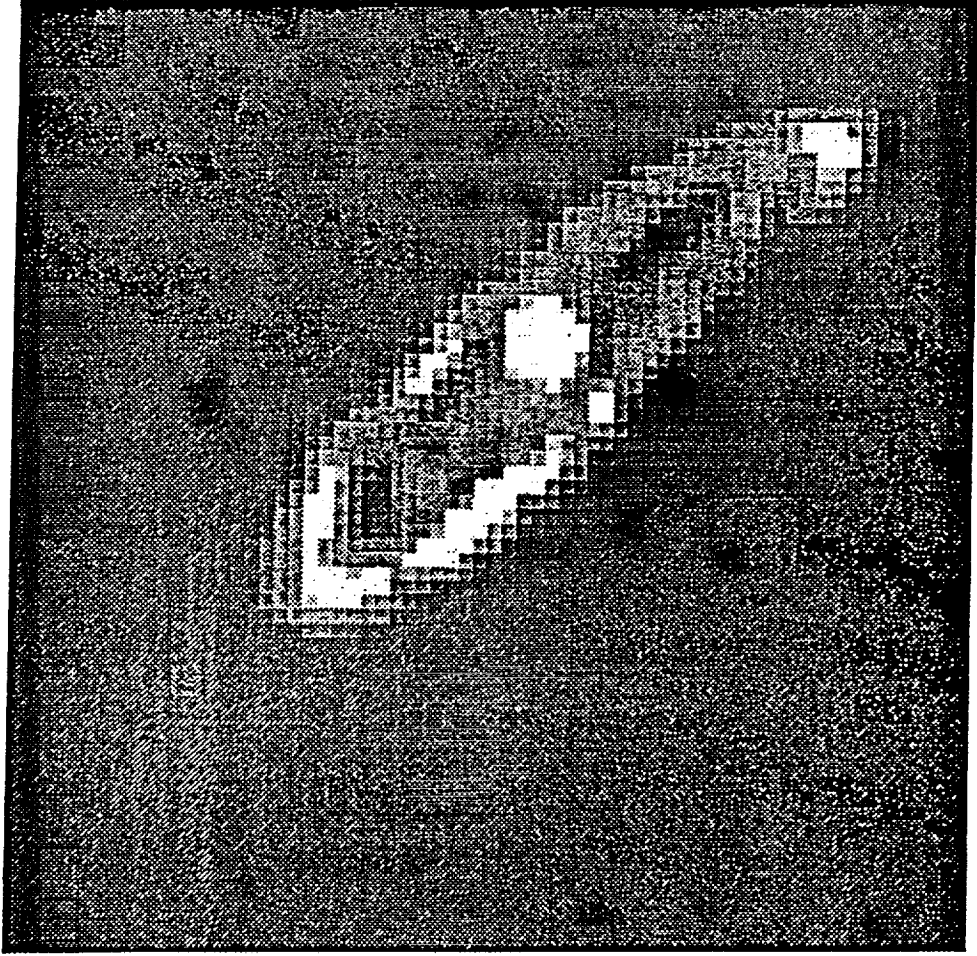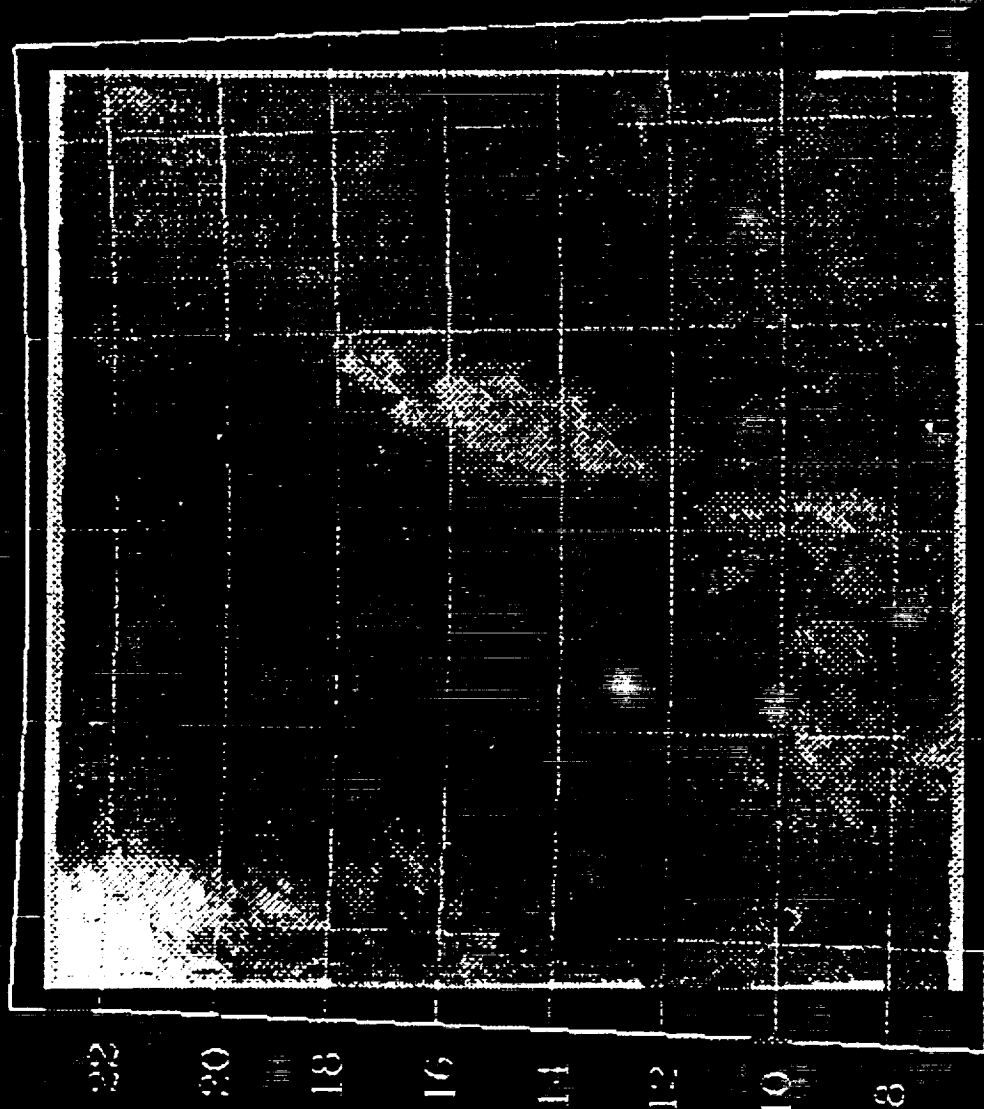Figure 2: IRAS_DISPLAY offers optional annotations, such as contour lines.

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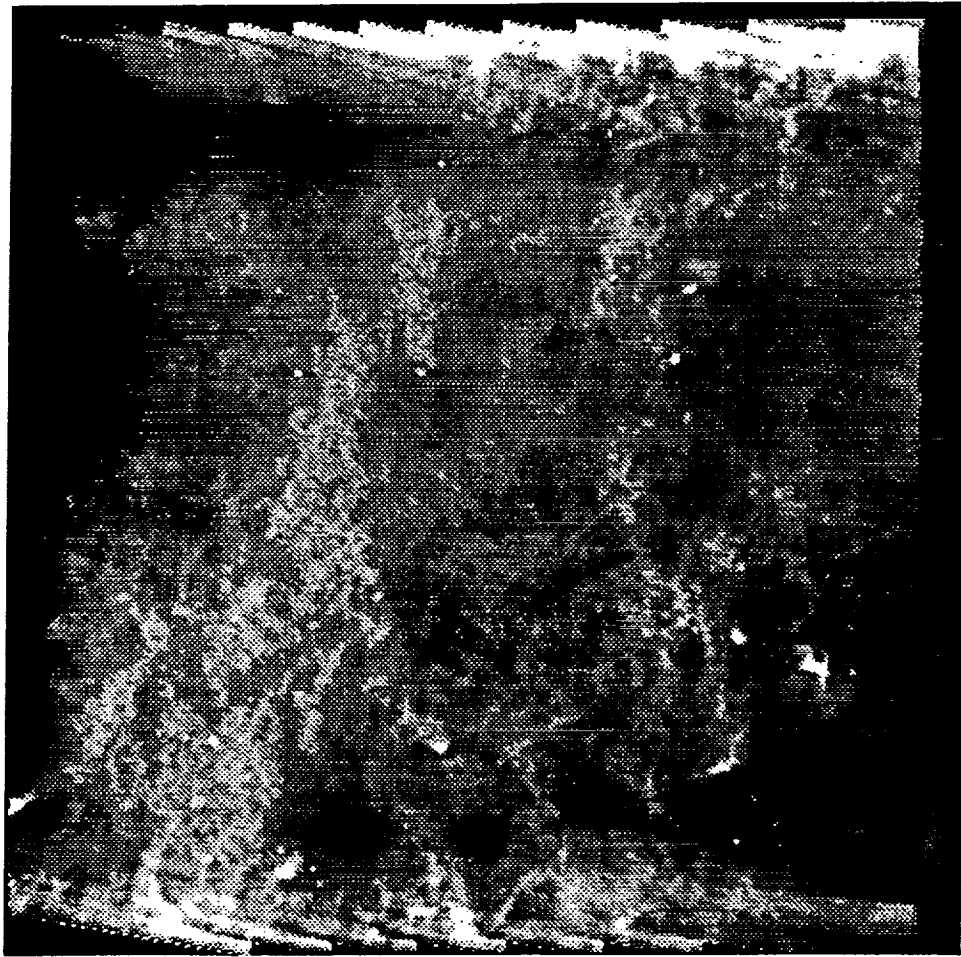eed of image restoration.

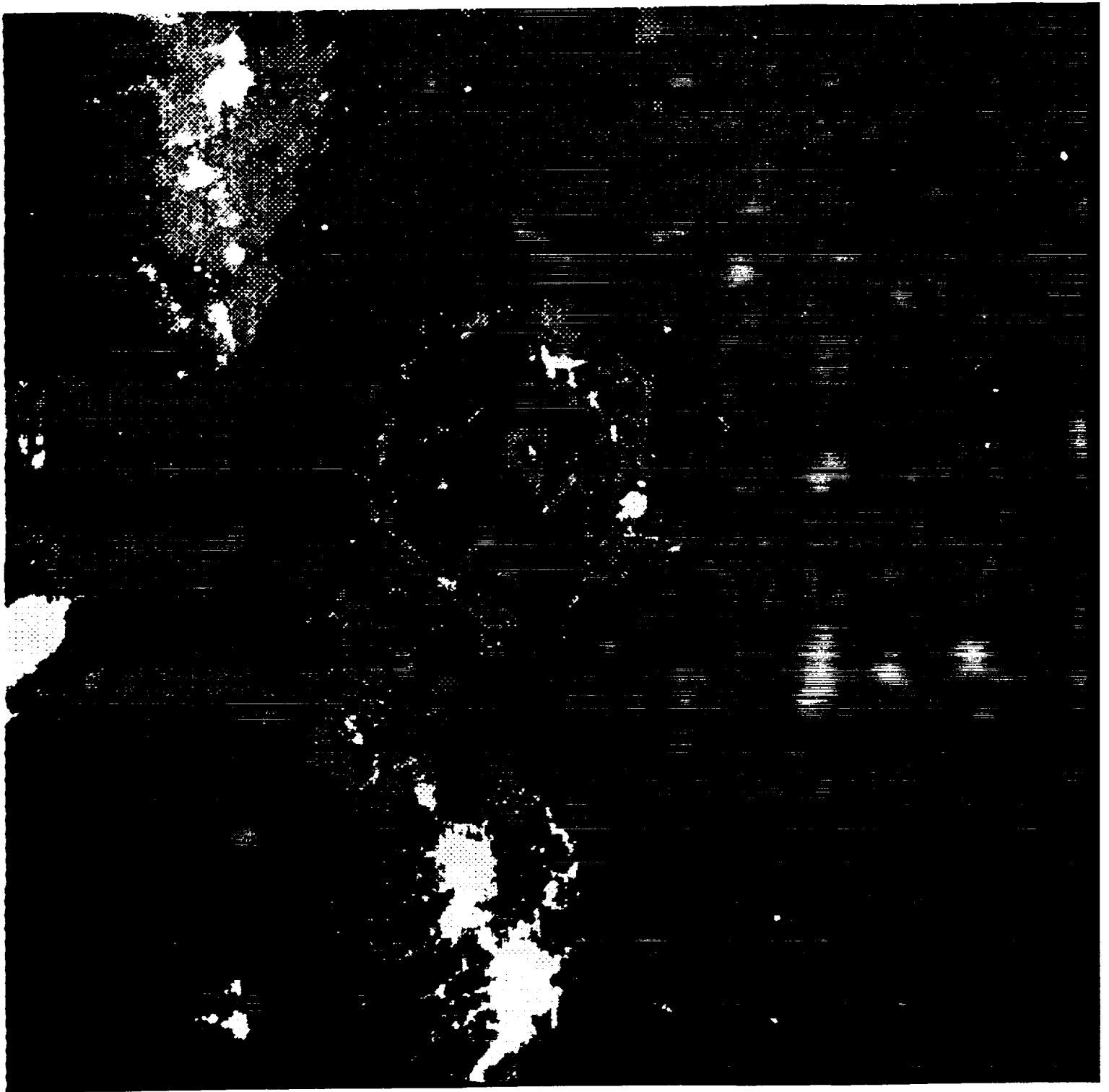Figure 5 (c): Skyflux Plate 75, band 3, after flattening and destriping (IRAS_DESTRIPE).

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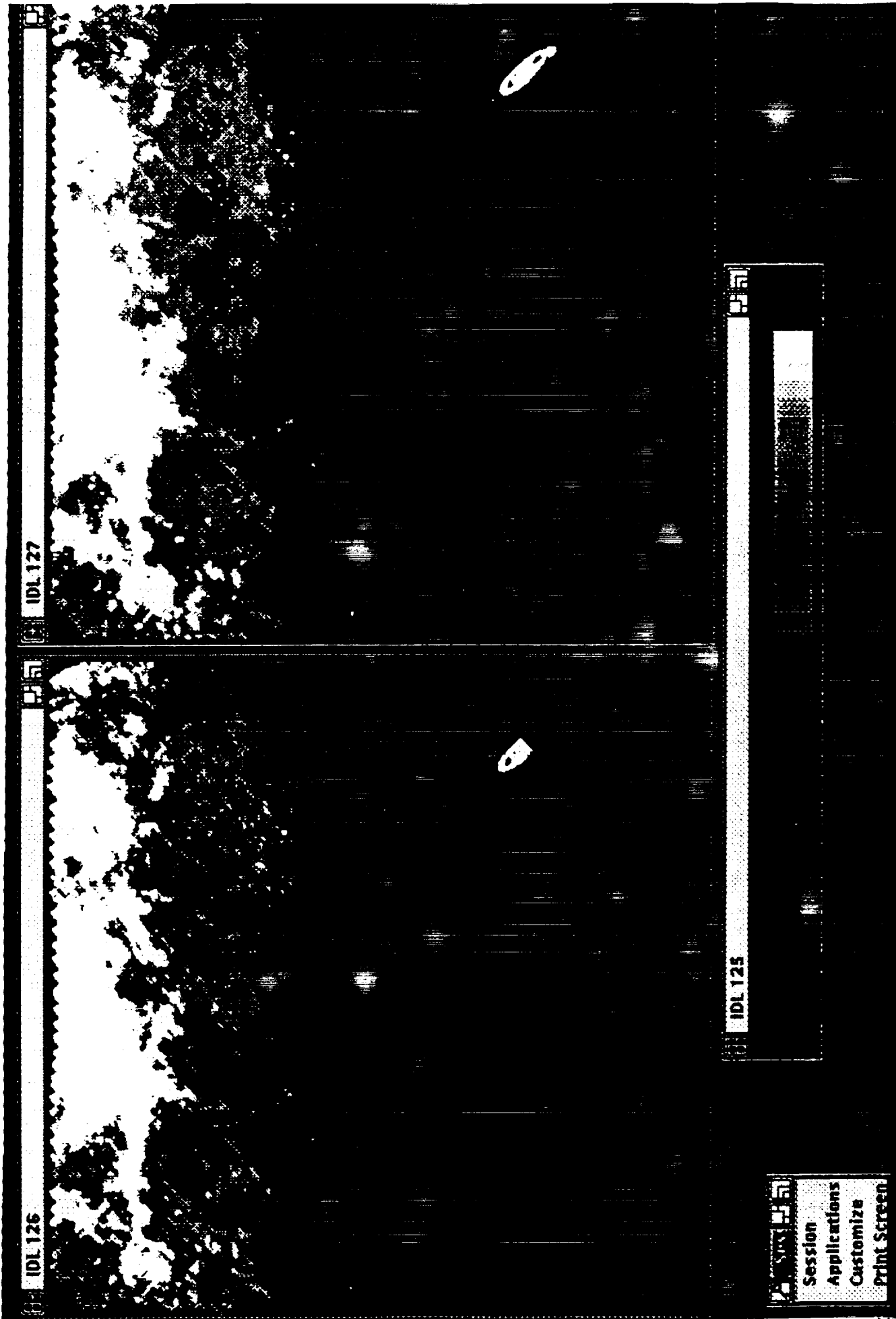
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